INEEL/EXT-2000-00257
Revision 1

Health and Safety Plan for Operable Unit 3-13, Group 4, Perched Water Project

December 2002

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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December 2002

Idaho National Engineering and Environmental Laboratory
Environmental Restoration Program
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
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ABSTRACT

This Health and Safety Plan (HASP) establishes procedures and requirements used to eliminate or minimize personnel health and safety risks while working on the Operable Unit 3-13, Group 4 Perched Water Project as required by the Occupational Safety and Health Administration standard "Hazardous Waste Operations and Emergency Response" (1910.120 and/or 1926.65). This HASP contains information about the hazards involved in performing the work as well as the specific actions and equipment used to protect personnel while working at the task site.

This plan has been prepared to comply with the authorized safety basis as detailed in the Idaho Nuclear Technology and Engineering Center authorized safety basis and hazard classification per the applicable preliminary hazard assessment, auditable safety analysis, or safety analysis report, if applicable.

This HASP is intended to give safety and health professionals the flexibility to establish and modify site safety and health procedures throughout the entire span of site operations based on the existing and anticipated hazards without changing this document.

CONTENTS

FIGURES

TABLES

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
ARDC	Administrative Record and Document Control
ANSI	American National Standards Institute
BBWI	Bechtel BWXT Idaho, LLC
CAM	continuous air monitor
CERCLA	Comprehensive Environmental, Response, Compensation and Liability Act
CFA	Central Facilities Area
COC	contaminant of concern
CRC	contamination reduction corridor
CRZ	contamination reduction zone
CWA	controlled work area
DAC	derived air concentration
dBA	decibel A-weighted
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EPA	Environmental Protection Agency
ERO	Emergency Response Organization
ES&H/QA	environment, safety, and health/quality assurance
EZ	exclusion zone
FFA/CO	Federal Facility Agreement and Consent Order
FTL	field team leader
GI	gastrointestinal
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air
HSO	health and safety officer
IDLH	immediately dangerous to life or health
IH	industrial hygiene
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center

ISMS	Integrated Safety Management System
JSA	job safety analysis
JSS	job site supervisor
LEL	lower explosive limit
NEPA	National Environmental Policy Act
NIOSH	National Institute of Occupational Safety and Health
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
OU	operable unit
PEL	permissible exposure limit
PM	project manager
PPE	personal protective equipment
RadCon	Radiological Control
RCIMS	Radiological Control and Information Management System
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RE	radiation engineer
RI/BRA	remedial investigation/baseline risk assessment
ROD	Record of Decision
RWP	radiological work permit
SAM	Sample and Analysis Management
SCBA	self-contained breathing apparatus
SE	safety engineer
SH&QA	safety, health, and quality assurance
SRPA	Snake River Plain Aquifer
STEL	short-term exposure limit
STR	subcontractor technical represenative
SWP	safe work permit
SZ	support zone
TLV	threshold-limit value
TRAIN	Training Records and Information Network
TRU	transuranic
TWA	time-weighted average

UV	ultraviolet light
VPP	Voluntary Protection Program
WAG	waste area group
WCC	Warning Communications Center

Health and Safety Plan for Operable Unit 3-13, Group 4, Perched Water Project

1. INTRODUCTION

This Health and Safety Plan (HASP) establishes the procedures and requirements that will be used to eliminate or minimize health and safety hazards to personnel working on the Operable Unit (OU) 3-13, Group 4 Perched Water Project, hereafter referred to as the "Perched Water Project" at the Idaho National Engineering and Environmental Laboratory (INEEL) located within the State of Idaho as shown in Figure 1-1.

1.1 Purpose

This HASP complies with the authorized safety basis detailed in the Idaho Nuclear Technology and Engineering Center (INTEC) authorized safety basis and "Other Industrial" classification per the applicable preliminary hazard assessment, auditable safety analysis, or safety analysis report, if applicable.

This HASP has been reviewed and revised, as deemed appropriate, by the Waste Area Group (WAG) 3 safety and health point of contact and by the health and safety officer (HSO) in conjunction with other project personnel and management to ensure its effectiveness and suitability.

This HASP governs all work that is performed by INEEL personnel and other companies, or employees of other companies, in support of the OU 3-13 Post-Record of Decision (ROD) Vadose Zone and Aquifer Well Drilling Projects. People not normally assigned to work at the site, such as representatives of the Department of Energy (DOE), the State of Idaho, Occupational Safety and Health Administration (OSHA), and the Environmental Protection Agency (EPA) are considered nonworkers who fall under the definition of "occasional site workers" as stated in OSHA 29 CFR 1910.120 / 29 CFR 1926.65.

1.2 The Idaho National Engineering and Environmental Laboratory

The INEEL, formerly the National Reactor Testing Station, encompasses an area of 2,305 km^2 (890 mi^2). It is located approximately 55 km (34 mi) west of Idaho Falls, Idaho (see Figure 1-1).

The United States Atomic Energy Commission, now the DOE, established the National Reactor Testing Station in 1949 as a site for building and testing a variety of nuclear facilities. The INEEL has also been a storage facility for transuranic (TRU) radionuclides and radioactive low-level waste since 1952. At present, the INEEL supports the engineering and operations efforts of DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology and conservation programs. The Department of Energy Idaho Operations Office (DOE-ID) has responsibility for the INEEL, and designates authority to operate the INEEL to government contractors. Bechtel BWXT Idaho, LLC (BBWI), the current primary contractor for DOE-ID at the INEEL, provides managing and operating services to the majority of INEEL facilities.

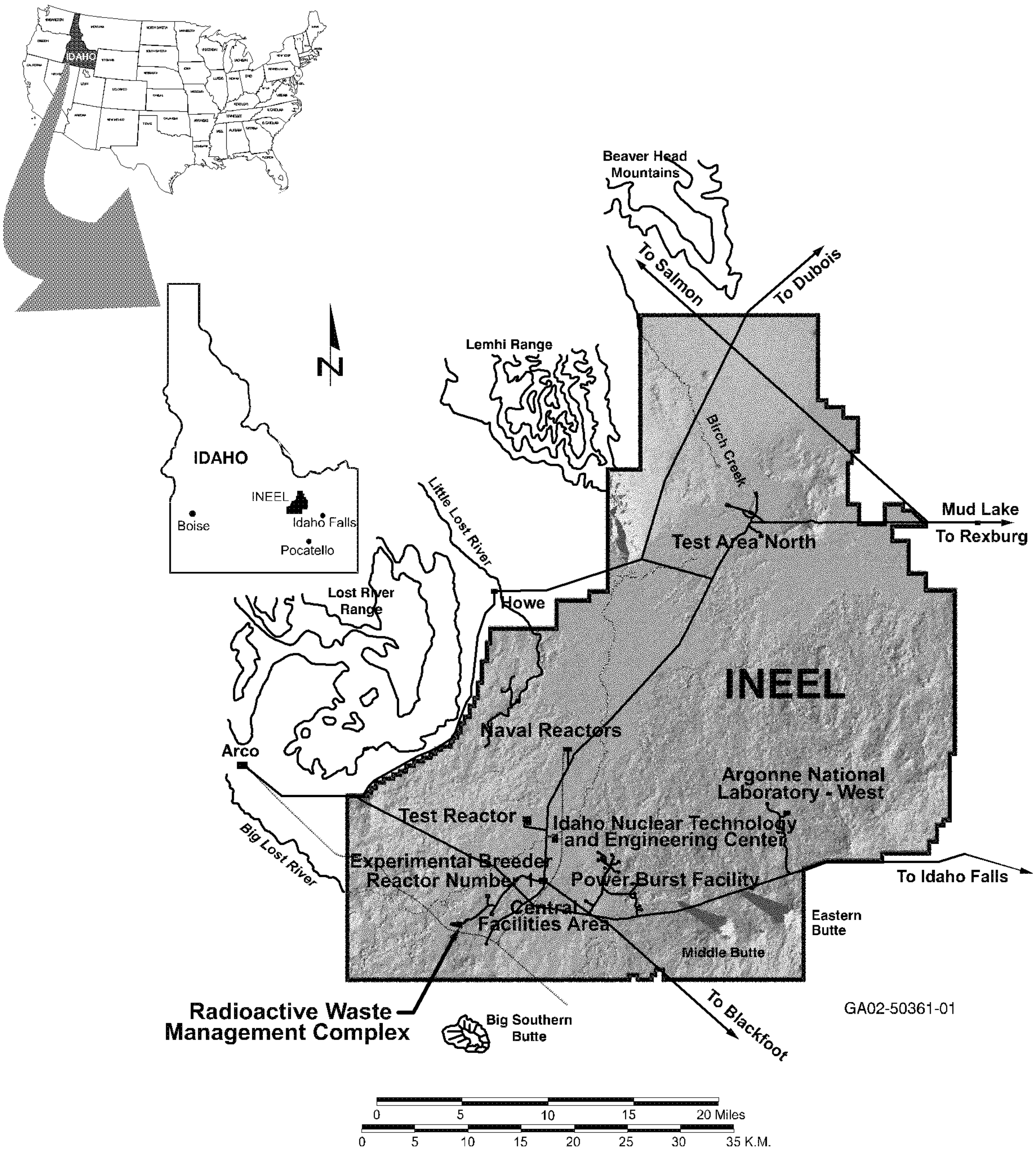

Figure 1-1. Map of the Idaho National Engineering and Environmental Laboratory.

Because of soil and groundwater contamination resulting from past operations, the INEEL was placed on the *National Priorities List* in November 1989. A Federal Facility Agreement and Consent Order (FFA/CO), to direct the cleanup activities at the INEEL, was negotiated and signed on December 9, 1991, with the EPA and the Idaho Department of Environmental Quality. The INEEL was subdivided into 10 WAGs to facilitate management of the cleanup. This HASP specifically addresses work that will be performed at INTEC, which is a facility within the INEEL. The INTEC is designated as WAG 3. Figure 1-1 identifies the INEEL in Idaho and the major facility locations inside the INEEL.

1.3 INTEC Site Description

The INTEC, previously named the Idaho Chemical Processing Plant, has been in operation since 1954. The INTEC has historically been a uranium reprocessing facility for defense projects and for the research and storage of spent nuclear fuel. In 1992, the DOE phased out the reprocessing operations and rescoped the mission: (1) to receive and temporarily store spent nuclear fuel and other radioactive wastes for future disposition, (2) to manage waste, and (3) to perform remedial actions. Figure 1-2 is a map of the INTEC.

A comprehensive operable unit, OU 3-13, was established to provide an overall evaluation of previously identified release sites at the INTEC. During 1997, a remedial investigation and baseline risk assessment (RI/BRA) was completed. The RI/BRA identified contaminants in the vadose zone and perched water and the Snake River Plain Aquifer (SRPA). The contaminants detected are identified and discussed later in this HASP in Section 3, Hazard Assessment.

During the preparation of the OU 3-13 remedial investigation/feasibility study, it became apparent that sufficient data were not available to select groundwater flow and transport model parameters with respect to the tank farm. Therefore, the tank farm release sites defined, as Group 1 in the OU 3-13 Feasibility Study Supplement Report (DOE-ID 1998), were to be further investigated as OU 3-14. This allowed for two decisions regarding risks to the SRPA. Operable Unit 3-13 provided a decision for risks to the SRPA outside the INTEC fence, and OU 3-14 was to provide a decision inside the INTEC fence.

Subsequent to the OU 3-13 RI/BRA, an evaluation of remedial alternatives was made in a feasibility study and the selected alternatives were described in the OU 3-13 ROD (DOE-ID 1999). Subsequently, a rescoping of OU 3-14 occurred in late 1999. This rescoping led to the reassignment of the OU 3-14 aquifer well drilling project, planned as a remedial investigation, to OU 3-13 monitoring programs. This HASP was prepared to support post-ROD monitoring and to be implemented as part of the remedial actions for the perched water and the SRPA.

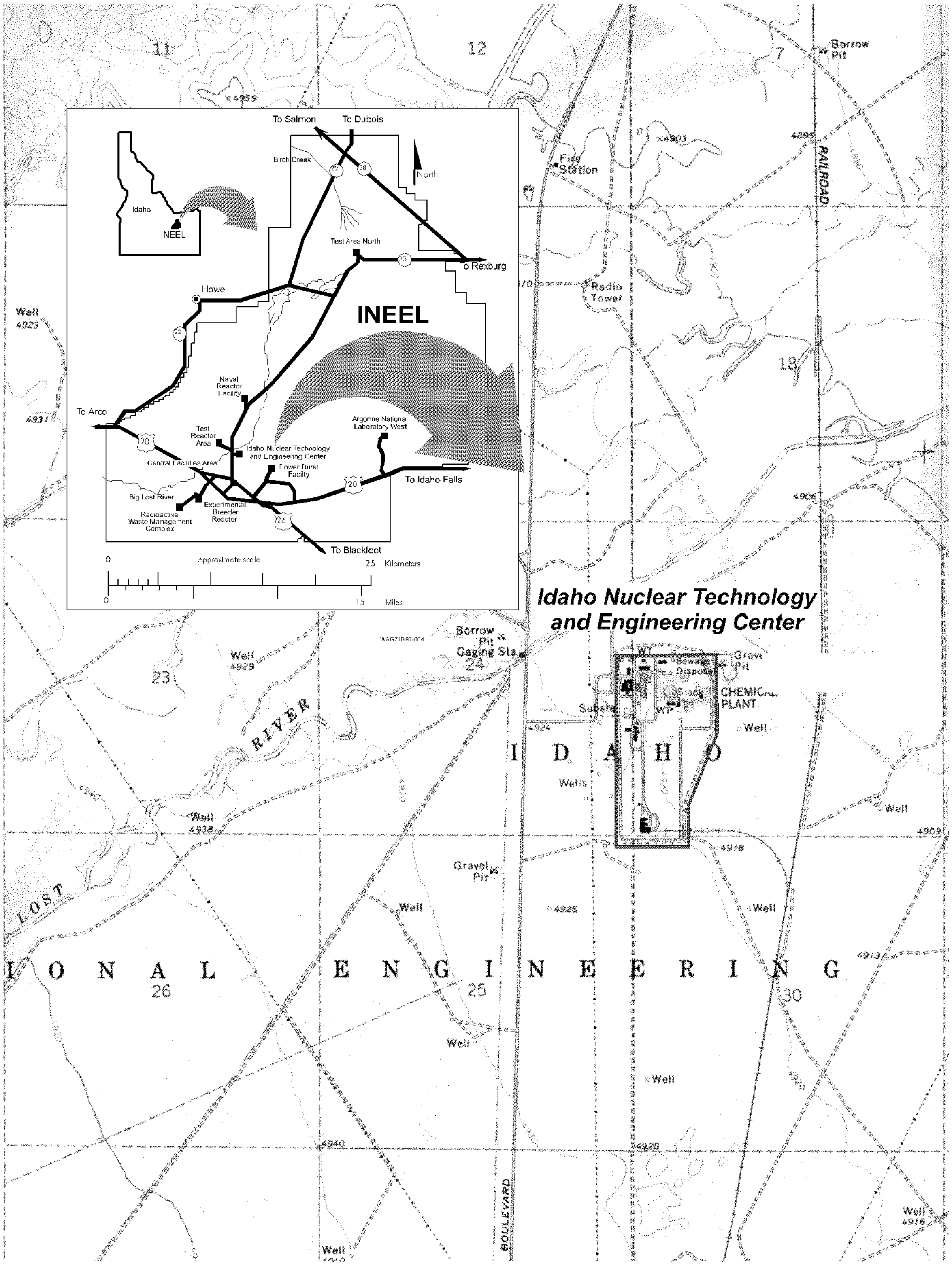

Figure 1-2. Map of the INTEC.

2. SITE BACKGROUND AND PROJECT SCOPE

Group 4 perched water wells have been mostly completed in key stratigraphic units of sediment or interbeds. A phased approach to perched well installation is proposed. During Phase I, the nature and extent of perched water sources around the tank farm and the percolation ponds were largely determined. Also included in Phase I activities were tracer test studies and perched water sampling which will continue, as deemed necessary. Phase II activities include well installation and routine sampling activities. Remedial objectives for these wells are defined in the OU 3-13 ROD (DOE-ID 1999).

2.1 Phase I Activities

The Phase I wells were drilled (see Figure 2-1) to better determine the perched water recharge sources and in particular, to support the tracer tests. The goal of each tracer test (and the well location selection) is to provide information about the hydraulic connection between the recharge sources and the upper and lower perched water zones.

Perched water sampling will continue be performed at the three depths of concern: alluvium/basalt interface 9.0 to 13.7 m (~30 to 45 ft), upper perched water (33.5 to 36.6 m [110 to 140 ft]), and lower perched water (115.8 to 128 m [380 to 420 ft]). The deepest well in each set will be drilled first. After the deep well is drilled, it will be geophysically logged. The borehole geophysical logs provide information on stratigraphy and locations of perched water; they also are used to determine completions for each subsequent well in the set. Drilling of the subsequent wells is accomplished through reverse air rotary drilling with a conversion to core drilling near the interbeds targeted for sampling. The boreholes are completed with tensiometers, suction lysimeters, and a piezometer. This approach provides the best control possible for the tracer test.

Soil samples are collected for analysis of contaminant concentrations, hydraulic, and geochemical properties. Additional sample material are retained for contaminant transport studies (batch and column test) and archival samples for treatability studies.

As a part of this phase, groundwater samples are collected as part of the tracer test. Samples will also be collected and analyzed for contaminants of concern (COCs). Actions associated with this task involve well purging and sample collection.

2.2 Phase II Activities

Phase II consists of two specific tasks: (1) the installation of wells to provide moisture monitoring and COCs sampling locations and (2) monitoring the perched water drain out and flux to the SRPA. The well sets will contain at least three wells, one to be completed in the upper perched water zone, another to be completed in the lower perched water zone, and a third to be completed in the SRPA. Wells at these depths will be instrumented with tensiometers for measuring soil matric potential and with piezometers and lysimeters for collection water sample for COC analysis. The aquifer skimmer well will be screened across the water table. Actual completion depth to the bottom of the screen will be slightly below the SRPA water table ~140 m [460 ft]). The skimmer well will be used for sampling aquifer water to determine contaminant flux out of the vadose zone.

The monitoring of the perched water of the perched water drain out and flux is a requirement of the WAG 3 OU 3-13 ROD. The routine sampling events will continue for at least five years after the relocation of the percolation ponds. The scope of these routine monitoring activities are defined in the Operation and Maintenance Monitoring Plan (DOE-ID 2000a).

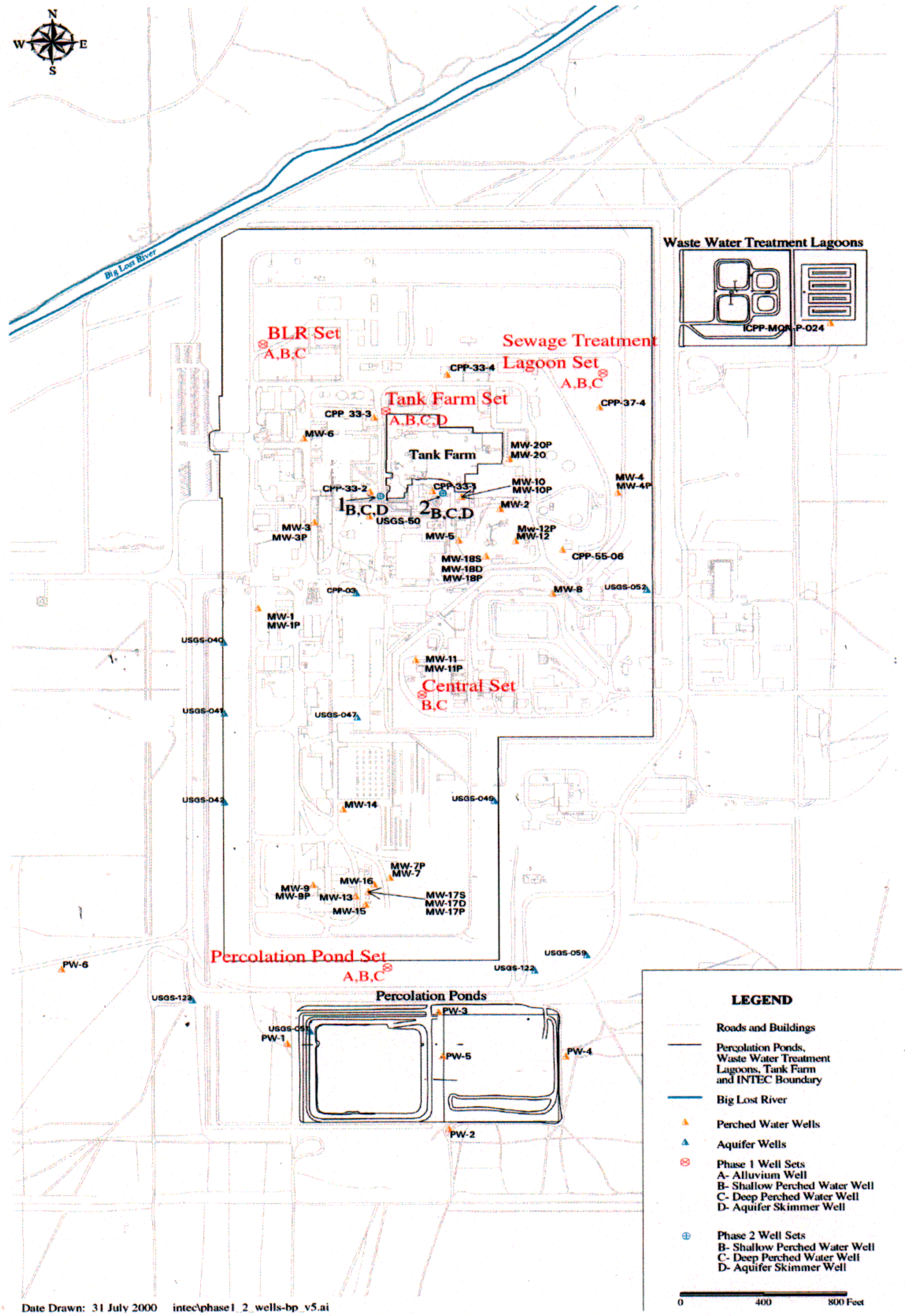

Figure 2-1. Proposed locations for perched water monitoring wells.

As a part of this phase, an initial round of groundwater samples will be collected. Samples will be collected and analyzed for COCs and water quality parameters. Actions associated with this task involve well purging and sample collection.

2.3 Phase II Routine Sampling

The Operation and Maintenance Plan (DOE-ID 2000b) covers the continued collection of groundwater samples from newly installed and existing wells and lysimeters. This activity will continue for a minimum of five years after relocation of the percolation ponds. Actions associated with this task involve well purging and sample collection.

2.4 Program Interfaces

The interface agreement between the program and the INTEC (IAG-89) describes the working relationships for activities and programs conducted at the INTEC. The programs at INTEC are being conducted under the regulatory authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 USC 6901 et seq.); the Final ROD for INTEC, WAG 3, OU 3-13 (DOE-ID 1999); and FFA/CO (DOE-ID 1991).

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3. HAZARD ASSESSMENT

This document contains requirements for both contractor and subcontractor personnel conducting work at the INEEL. Contract personnel normally comply with companywide applicable company polices, procedures, and manuals as well as requirements outlined in work control documents, job safety analyses (JSAs), radiological work permits (RWPs), and this HASP in addition to their established safety and health programs and procedures. Subcontractors will be held responsible to follow their company safety and health program and procedures in addition to contract outlined requirements.

3.1 Hazard Evaluation of Project Activities

Personnel may be exposed to safety hazards, or to chemical, radiological, and physical agents while working on project tasks. The degree of the hazards posed depends on the nature of contaminants encountered and the specific tasks being performed. Table 3-1 summarizes the anticipated hazards associated with various project activities. Table 3-2 identifies the contaminants and maximum concentration levels that have been detected in the respective media in the project area (from the OU 3-13 Remedial Investigation/Feasibility Study [Rodriguez et al. 1997] and OU 3-13 ROD [DOE 1999]) that project personnel could be potentially exposed. Additional contaminants and associated levels determined by applicable company polices and procedures.

Table 3-1. Project activities and associated hazards.

Activity or Task	Associated Hazards or Hazardous Agent
Mobilization/Demobilization	Industrial safety hazards Heavy equipment for site preparation Heat or cold stress Back strain Noise
Drilling activities; soil, water and rock sampling; geophysical logging	Overhead power lines/obstructions Industrial safety hazards Heat or cold stress Back strain Noise Radiological and inorganic contaminants
Well and instrumentation installation	Industrial safety hazards Heat or cold stress Back strain Silica flour inhalation
Equipment decontamination	Industrial safety hazards Heat or cold stress Back strain Noise Radiological and inorganic contaminants

Table 3-2. Contaminants and maximum concentration levels.

Contaminants in unconsolidated soil, interbed sediments, and basalts

Contaminant	Maximum Concentration Level
Gross alpha activity	up to about 25 picocuries/gram (pCi/g)
Gross beta activity	up to about 25 pCi/g
Sr-90	up to about 800 pCi/g
Am-241	-
Cs-137	-
Eu-154	-
Pu-238	-
Pu-239/240	-
Pu-241	-
U-235	-

Contaminants in perched water

Contaminant	Maximum Concentration Level
Iodine-129	trace levels
Sr-90	up to about 100,000 picocuries/liter (pCi/l)
Tritium	up to about 25,000 pCi/l
Technetium	up to about 736 pCi/l
Cs-137	-
Pu	-
Mercury	23 mg/kg
Nitrate	35.4 mg/L
Chloride	250 mg/L
Manganese	165 ug/L
Iron	324 ug/L

Contaminants in SRPA groundwater

Contaminant	Maximum Concentration Level
Tritium	up to about 30,000 pCi/l
Sr-90	up to about 20 pCi/l
Iodine-129	up to about 1 pCi/l
Technetium-99	up to about 20 pCi/l
Pu-238	-
Pu-239	-
Pu-240	-
Chromium and mercury	trace levels

The project activities may involve radiological hazards which will be monitored by on-Site radiological control technicians (RCTs), as they determine necessary. RCTs will develop RWPs, as needed, in accordance with applicable company manuals. Safe work permits may be prepared using applicable company polices and procedures. For instances where the project/task JSA does not address task hazards, a safe work permit (SWP) may be used as a temporary means of hazard identification and mitigation until the JSA is updated to reflect identified hazards. The RWP and JSAs will be used in conjunction with this HASP to address hazardous and radiological conditions at the site. These documents will augment this HASP and further detail protective measures, personal protective equipment (PPE), and dosimetry requirements.

Table 3-3 presents an evaluation of these radiological and inorganic contaminants with respect to potential routes of exposure and symptoms of over-exposure. Additionally, the exposure potential by all routes is stated based on quantity of material present and toxicity.

3.2 Routes of Exposure

Exposure pathways for hazardous materials and radionuclides are directly related to the nature of the project tasks. The exposure pathways for the radionuclides will be described in the RWP. Engineering controls (high-efficiency particulate air filtration), continuous monitoring, training, and work controls will mitigate potential contact and uptake of these hazards; however, the potential for exposure to contaminants still exists.

Exposure pathways include:

- Inhalation of radionuclide-contaminated fugitive dusts during intrusive activities and decontamination tasks. This contamination form may have trace amounts of inorganic compounds with radionuclides, resulting in potential lung deposition.

- Skin absorption and contact with radionuclides and inorganic compounds during exposure potential, that can be absorbed through unprotected skin or corrosion, resulting in chemical burns, uptake through skin absorption and/or skin contamination, and type of work will be described in the SWP or RWP.

- Ingestion of radionuclides and inorganic compounds adsorbed to dust particles or waste residues exposure potential, uptake of contaminants through the gastrointestinal (GI) tract that result in GI irritation, internal tissue irradiation, and/or deposition to target organs, and type of work will be described in the SWP or RWP.

- Injection while handling radionuclides and inorganic compounds by breaking of the skin, or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

Table 3-3. Evaluation of inorganic and radiological contaminants.

Material or Chemical (CAS No.)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure [b]	Symptoms of Overexposure[c] (Acute and Chronic)	Target Organs/System	Carcinogen (source)[d]	Exposure Potential[e] (all routes without regard to PPE)
Metals and Inorganic Compounds						
Bentonite (sodium bentonite) 7631-86-9	10 mg/m^3 (inert nuisance dust)	Ih, Con	Mucous membrane and respiratory tract irritation	Lungs	No	Moderate-high potential (used for well completion)
Silica, Crystalline (dust) 14464-46-1	0.05 mg/m^3 (respirable fraction)	Ih, Con	Pulmonary fibrosis, silicosis	Respiratory, eyes	No	Moderate-high potential Mixing of silica sand and flour for well completion
Silica, Crystalline quartz (14464-46-1)	10 mg/m^3 (%SiO2+2) (respirable fraction)	Ih, Con	Pulmonary fibrosis, silicosis	Respiratory, eyes		Moderate-high potential Mixing of silica sand and flour for well completion
Chromium (7440-47-3)	ACGIH TLV - 0.5 mg/m^3	Inh, Ing, Con	Irritation of eyes and skin, lung fibrosis (historogic)	Eyes, skin, respiratory tract	No	Low potential
Mercury (7439-97-6)	ACGIH TLV - 0.025 mg/m^3	Inh, Ing, Con, Abs	Irritation eyes, skin; cough, chest pain, dyspnea, bronchial pneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; gastrointestinal disturbance, anorexia, low weight	Eyes, skin, respiratory tract, central nervous system, kidneys	No	Low potential
Radiological Contaminants. The dominant radioisotopes are tritium and strontium-90						
Radionuclides (whole body exposure)	INEEL- 1.5 rem/yr project ALARA dose limit-per RWP or ALARA Task Posting of radiation areas per INEEL RCM	Whole body	No symptoms expected	Blood forming cells, GI tract, and rapidly dividing cells	Yes	Low potential Low doses from repeated handling of sample cores and from handling water samples

a. American Conference of Governmental Industrial Hygienists (ACGIH) 1997 TLV Booklet and OSHA 29 CFR 1910 substance specific standards.
b. (Inh) inhalation; (Ing) ingestion; (Abs) skin absorption; (Con) contact hazard.
c. (nervous system) dizziness/nausea/lightheadedness; (dermis) rashes/itching/redness; (respiratory) respiratory effects; (eyes) tearing/irritation;
d. If yes, identify agency and appropriate designation (ACGIH A1 or A2; NIOSH; OSHA; IARC; NTP).
e. Estimates (~) of specific compounds from Tables 3-2 and 3-3.

DAC = derived air concentration
IE = ionization energy
eV = electron volts
NTP = National Toxicology Program
GI = gastrointestinal
PEL = permissible exposure limit
IARC = International Agency for Research on Cancer
TLV = threshold limit value

MSDSs for these chemicals are available at the OU 3-13 vadose zone trailer.

3.3 Environmental and Personnel Monitoring

The potential for exposure to radiological and nonradiological hazards exists during many of the tasks that will take place during the OU 3-13 Post-ROD Vadose Zone Monitoring and Aquifer Drilling project and affects all personnel who work in the contamination reduction zone (CRZ) and exclusion zone (EZ). Site Control and Security (Section 8), engineering and administrative controls, worker training, and the use of protective equipment will mitigate most of these hazards to a large degree. Monitoring with direct-reading instruments will be conducted to provide Radiological Control (RadCon) and industrial hygiene (IH) personnel with real-time data to assess the effectiveness of these controls. IH will use direct-reading instrumentation for mercury and noise only on this project.

The greatest exposure potential(s) for the project will be described in the SWP and/or RWP. The IH and RadCon personnel will focus on the activities and monitor with direct-reading instrumentation, swipes, and full and partial period air sampling in accordance with the applicable TPRs, written for the project, and/or other guidelines, as deemed appropriate. Other workers and areas of the site will also be monitored to verify the integrity of core sample packages, to ensure that contamination has not migrated from radionuclide-contaminated material areas or waste containers, and to determine the effectiveness of contamination control and decontamination practices.

Personnel working on the project may be exposed to hazardous materials or hazardous physical agents, as already described. Safety hazards and other physical hazards will be monitored and controlled, as outlined in Section 3.4.

3.3.1 Industrial Hygiene Monitoring

When there is a potential for the spread of contamination during the drilling process or work associated with the drilling process, characterization monitoring for surface radionuclide contamination may provide an additional indicator of nonradiological hazards. Various direct-reading instruments and other semiquantitative detection tests will be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, and professional judgement. All full and partial period airborne contaminant sampling will be conducted, using applicable NIOSH or OSHA methods and conforming to applicable company manuals. Risk assessments for site personnel will be conducted according to applicable company polices and procedures.

3.3.1.1 Industrial Hygiene Instrument and Equipment Calibration. All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations and existing IH protocol and in conformance to applicable company polices and procedures. Direct-reading instruments will be calibrated, at a minimum, prior to daily use and more frequently, as determined by the project IH. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded, as described in Section 13.

3.3.2 Radiological Monitoring

During this project, the potential exists for exposure to both external and internal radiation (inhalable, ingestible, or absorbed radioactive contaminants). As with the nonradiological contaminants discussed above, the greatest potential for both external and internal radiation exposures will be described in the RWP and/or work order. Monitoring will be performed in accordance with the applicable company polices and procedures.

Based on the unique and distinctive hazards presented by both external and internal radiation sources, they will be evaluated, controlled, and monitored individually (although the detection of any radionuclides will serve to alert for the presence of both). For purposes of this monitoring section, they will be discussed separately and distinguished by their effects as radiation (external) and contamination (internal). Radiological monitoring will include area, airborne, equipment, and personnel monitoring. These data will be used by RadCon personnel to evaluate the effectiveness of engineering controls, ensure the adequacy of work zone boundaries, alert project personnel to potential high radiation sources, and ensure the effectiveness of decontamination methods and practices.

3.3.3 Radiological Engineer and Industrial Hygiene Exposure Assessments

Although the potential for exposure to site contaminants is anticipated to be low for this project, action levels for suspected radiological contaminants are established and presented in Table 3-4 to prevent and mitigate potential personnel exposure. If action levels are reached, personnel will take the appropriate actions listed in Table 3-4. Nonradiological action levels in Table 3-4 are limited to noise exposure.

3.4 Physical Hazards Evaluation, Control, and Monitoring

The physical hazards present at the project area and the methods that will be used to monitor and control them are described in this section. It is critical that all personnel are aware and understand the nature of the tasks to be conducted, the equipment to be used, and the controls to be in place to eliminate or mitigate potential safety hazards.

3.4.1 Temperature and Ultraviolet Light Hazards

Project tasks will be conducted during times when there is a potential heat and cold stress that could present a potential hazard to personnel. The industrial hygienist and HSO will be responsible for obtaining meteorological information to determine if additional heat or cold stress administrative controls are required. All project personnel must understand the hazards associated with heat and cold stress and take preventive measures to minimize the effects. Applicable company policies and procedures guidelines will be followed when determining work-rest schedules or when to halt work activities due to temperature extremes.

3.4.1.1 Heat Stress. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort, unconsciousness, to death. In addition, tasks requiring the use of protective equipment or respiratory protection prevent the body from cooling. Personnel must inform the field team leader (FTL) or HSO when experiencing any signs or symptoms of heat stress or observing a fellow employee (i.e., buddy) experiencing them. Heat stress stay times will be documented on the appropriate work control document(s), that is, an SWP, Pre-Job Briefing Form, or other by the HSO in conjunction with the IH (as required) when personnel wear PPE that may increase heat body burden. These stay times will take into account the amount of time spent on a task, the nature of the work (i.e., light, moderate, or heavy), type of PPE worn, and ambient work temperatures. Table 3-5 lists heat stress signs and symptoms of exposure.

Table 3-4. Action levels and associated responses for anticipated project hazards.

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels Exceeded
Hazardous noise levels	<85 dBA 8-hour TWA, <83dBA 10-hour TWA	No action
	85–114 dBA	Hearing protection is required to attenuate to below 85 dBA 8-hour TWA or 83 dBA for 10-hour TWA (based device NRR).
	(a) >115 dBA (b) >140 dBA	(a) Isolate source, evaluate NRR for single device, double protection, as needed. (b) Control entry, isolate source, wear only approved double protection.
Radiation field	<5 mrem/hr	No action, no posting is required.
	5–100 mrem/hr @ 30 cm (§835.603.b)	Post as "Radiation Area." Required items include radiation worker I training or II training, RWP, personal dosimetry.
	>100 mrem – 500 Rad @ 100 cm (§835.603.b)	Post as "High Radiation Area." Required items include RW II training, RWP, alarming personal dosimetry, dose rate meter, and temporary shielding, as required.
	Exceed remote air monitor alarming set point, if required (fast ringing bell, flashing red light)	Evacuate area immediately, muster at CRZ and await instruction from RCT.
Radionuclide contamination	1–100 times company determined limits (§835.603.d)	Post as "Contamination Area." Required items include RW II training, personal dosimetry, RWP, PPE, bioassay submittal, as required.
	>100 times company determined limits (§835.603.d)	Post as "High Contamination Area." Required items include RW II training, personal dosimetry, RWP (with prejob briefing), PPE, bioassay submittal, as required.
Airborne radioactivity	Concentrations (µCi/cc) >30% of DAC value (§835.603.d)	Post as "Airborne Radioactivity Area." Required items include RW II training, personal dosimetry, RWP (with prejob briefing), PPE, bioassay submittal, as required.
	Exceed continuous air monitor alarming set point, (fast ringing bell, flashing red light)	If not in Level B respiratory protection, evacuate upwind to CRZ, await RCT. If in Level B respiratory protection, leave immediate area to upwind location, maintain airline connection and await RadCon instructions.

TWA = time-weighted average
dBA = decibel A-weighted
NRR = Nuclear Reactor Regulation

Table 3-5. Heat stress signs and symptoms of exposure.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating.	Keep the skin clean, change all clothing daily, and cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps and exhaustion, sometimes with dizziness or periods of faintness.	Move the patient to a nearby cool place. Give the patient half-strength electrolytic fluids; if cramps persist, or if signs that are more serious develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; cold, clammy skin; heavy perspiration; total body weakness; dizziness that sometimes leads to unconsciousness.	Move the patient to a nearby cool place, keep the patient at rest, give the patient half-strength electrolytic fluids, treat for shock, and seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching.	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

Note: Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. The FTL or designee should immediately request an ambulance (777, 526-1515 , or 9-911 from cell phones) be dispatched from the Central Facilities Area (CFA) -1612 medical facility and the individual cooled as described above in Table 3-5 based on the nature of the heat stress illness.

3.4.1.2 Low Temperatures and Cold Stress. Personnel will be exposed to low temperatures during fall and winter months or at other times of the year if relatively cool ambient temperatures combined with wet or windy conditions exist.

Additional cold weather hazards may exist from working on snow- or ice-covered surfaces. Slip, fall, and material-handling hazards are increased under these conditions. Every effort must be made to ensure walking surfaces are kept clear of ice. The FTL or HSO should be notified immediately if slip or fall hazards are identified at the project locations.

3.4.1.3 Ultraviolet Light Exposure. Personnel exposed to ultraviolet light (UV) (i.e., sunlight) while conducting project tasks are reminded to protect themselves from sunlight. Sunlight is the main source of UV known to damage the skin and potentially cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. Since UV rays or suntans are unsafe, the following mitigative actions are recommended to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long-sleeve or short-sleeve shirt [no tank tops])
- Use a sunscreen with a minimum sun protection factor (SPF) of 15
- Wear a hat (hard hat where required)

- Wear UV-absorbing safety glasses
- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m. whenever possible.

3.4.2 Inclement Weather Conditions

When inclement or adverse weather conditions develop that may pose a threat to persons or property at the project site (e.g., sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), conditions will be evaluated and a decision made by the HSO with input from other personnel to halt work, employ compensatory measures, or proceed. The FTL and HSO will comply with INEEL MCPs and facility work control documents that specify limits for inclement weather.

3.4.3 Noise

Personnel working at the task site may be exposed to noise levels that exceed 85 decibels (dBA) for 8-hour time weighted average (TWA) and 83 dBA for 10-hour TWA. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear, pain, and temporary or permanent hearing loss
- Interfere with communication that would warn of danger.

Noise measurements will be performed by the IH per the applicable company polices and procedures to determine if personnel assigned to the jobs identified are above allowable noise exposure levels. A threshold–limit value (TLV) of 85 dBA (TWA) will be applied to personnel exposed to noise levels over no more than an 8-hour day. This level is based on a 16-hour "recovery" period in a low noise environment. If personnel are required to work longer than 8 hours in a hazardous noise environment, then the TLV will be adjusted to a lower value. The project IH must be consulted regarding modifications to the 85 dBA for an 8-hour TLV and 83 dBA for a 10-hour TWA value.

Personnel, whose noise exposure meets or exceeds the allowable level, will be enrolled in the INEEL Occupational Medical Program (OMP) or subcontractor Hearing Conservation Program. Personnel working on jobs that have noise exposures greater than 85 dBA (83 dBA for 10 hour TWA), will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection specified by the IH until directed otherwise.

Individuals having experienced a permanent threshold shift should wear hearing protection at noise levels of 80 dBA or greater. Drilling operations are noisy and hearing conservation should be taken seriously by all exposed persons.

3.4.4 Fire, Explosion, and Reactive Materials Hazards

Fire, explosion, and reactive materials hazards at the task site include potential explosive atmospheres, combustible materials near ignition sources (hot motor or exhaust system), transfer and storage of flammable or combustible liquids in the support zone (SZ), and chemical reaction (reduction, oxidation, exothermic reaction) from incompatible waste materials. Portable fire extinguishers with a minimum rating of 10A/60BC will be strategically located at the site to combat Class ABC fires. They will be located in all active work areas, on or near site equipment with exhaust heat sources, and near all equipment capable of generating ignition or having the potential to spark. All project field team members will receive fire extinguisher training, as necessary, as part of this HASP training, as listed in Section 7, Table 7-1.

3.4.4.1 Project Equipment Fire Hazards. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. The project fire protection engineer will identify these sources as equipment is brought on the site. The accumulation of combustible materials will be strictly controlled during the project. Disposal of combustible materials will be assessed at the end of each shift. Class A combustibles such as trash, cardboard, rags, wood, and plastic will be properly disposed in metal receptacles in the SZ and in appropriate waste containers within the contamination reduction corridor (CRC), CRZ, and EZ.

Fuels that will be used at the task site for equipment will be safely stored, handled, and used. Only Factory Mutual/Underwriters Laboratories-approved flammable liquid containers, labeled with the content, will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any facilities (trailers) and ignition sources or stored inside an approved flammable storage cabinet. Additional requirements are provided in applicable company polices and procedures. Portable motorized equipment such as generators and light plants will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions prior to refueling to minimize the potential for a fuel fire. Refueling tasks will only be conducted by qualified fuel handling personnel.

3.4.5 Biological Hazards

The INEEL is located in an area that provides habitat for various rodents, insects, and vectors (i.e., organisms that carry disease-causing microorganisms from one host to another). The potential exists for encountering nesting materials or other biological hazards and vectors. The Hantavirus may be present in the nesting and fecal matter of deer mice. If such materials are disturbed, they can become airborne and create a potential inhalation pathway for the virus. Contact and improper removal of these materials may provide additional inhalation exposure risks.

If suspected rodent nesting or excrement material is encountered, the industrial hygienist will be notified immediately and **no attempt will be made to remove or clean the area**. Following an evaluation of the area, disinfection and removal of such material will be conducted in accordance with applicable company policies and procedures.

Snakes, insects, and arachnids (e.g., spiders, ticks, and mosquitoes) also may be encountered. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter. Protective clothing will generally prevent insects from direct contact with the skin. If potentially dangerous snakes or spiders are found or are suspected of being present, warn others, keep clear and contact the industrial hygienist or HSO for additional guidance as required.

Insect repellant (DEET or equivalent) may be required. Areas where standing water has accumulated (e.g., evaporation ponds) provide breeding grounds for mosquitoes and should be avoided. In cases where a large area of standing water is encountered, it may be necessary to pump the water out of the declivity (areas other than the evaporation ponds).

3.4.6 Safety Hazards

Industrial safety hazards pose a significant potential threat to personnel who will be performing tasks during this project. Section 6 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed to eliminate or minimize potential hazards to project personnel.

3.4.6.1 Handling Heavy Objects. During the course of any drilling project, there are numerous tasks that require handling or moving heavy objects. Manual material handling will be minimized through task design and use of mechanical and/or hydraulic lifts, whenever possible.

3.4.6.2 Powered Equipment and Tools. All power equipment and tools will be properly maintained and used by qualified individuals according to the manufacturer's specifications. Applicable company polices and procedures will be followed for all work performed with powered equipment, including powered steam cleaners.

3.4.6.3 Heavy Equipment and Moving Machinery. The hazards, associated with the operation of heavy equipment, include injury to personnel, equipment damage, and/or property damage. All heavy equipment will be operated in the manner in which it was intended and according to manufacturer's instructions. Only authorized personnel will be allowed in the vicinity of operating heavy equipment and should maintain visual communication with the operator. Work-site personnel will comply with applicable company polices and procedures.

Site personnel working around or near heavy equipment and other moving machinery will comply with the appropriate applicable company polices and procedures. Additional safe practices will include:

- Ensuring that all heavy equipment has functional backup alarms.
- Prohibiting walking directly in back of or to the side of heavy equipment without the operator's knowledge; all precautions will have been taken prior to moving heavy equipment.
- While operating heavy equipment in the work area, the equipment operator will maintain communication with a designated person responsible for providing direct voice contact or approved standard hand signals; in addition, all site personnel in the immediate work area will be made aware of the equipment operations.
- Keeping all equipment out of traffic lanes and access ways and storing it so as not to endanger personnel at any time.

3.4.6.4 Electrical Hazards/Energized Systems. Electrical equipment and tools, as well as underground lines, may pose shock or electrocution hazards to personnel. Safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the requirements in applicable company polices and procedures and Parts I through III of National Fire Protection Association 70E. In addition, all electrical work will be reviewed and completed under the appropriate work controls (i.e., HASP, SWPs, work orders).

Before beginning any subsurface penetrations, underground utility clearances will be obtained by contacting telecommunications (526-1688 or 526-2512). Subsurface investigation clearance will be obtained in accordance with applicable company polices and procedures. The requirements for advanced 48-hour notice will be met.

3.4.6.5 Personal Protective Equipment. Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear noise that might indicate a hazard and directions. Also, PPE can increase the risk of heat stress. Work activities at the task site will be modified, as necessary, to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply with applicable company polices and procedures. The OU 3-13 Post-ROD Monitoring Project PPE levels for each task are described in Section 6 and listed in Table 6-1 of that section.

3.4.6.6 Decontamination. Decontamination procedures for personnel and equipment are detailed in Section 10. The appropriate applicable company polices and procedures provide additional requirements for chemical and radionuclide decontamination requirements.

Decontamination procedures (Section 12) and applicable company polices and procedures must be followed and the appropriate level of PPE worn during decontamination activities. Project RadCon and IH personnel will follow applicable company polices and procedures, and general IH practices.

3.4.6.7 Inclement Weather Conditions. When inclement or adverse weather conditions develop that may pose a threat to people or property at the task site (such as sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), these conditions will be evaluated and a decision made by the FTL and STR with input from the HSO, IH, safety engineer (SE), RCT, and other project personnel, as appropriate, to stop work, employ compensatory measures, or to proceed. The FTL and STR will comply with INEEL MCPs and site work control documents that specify limits for inclement weather.

3.5 Other Site Hazards

Site personnel should continually look for potential hazards and immediately inform the FTL or HSO of the hazards so that action can be taken to correct the condition.

The FTL, HSO, RCT, and STR will conduct daily inspections of the task site to ensure that barriers and signs are being maintained, unsafe conditions are corrected, and debris is not accumulating on the site. These inspections will be noted in the FTL logbook. Health and safety engineers present at the task site may, at any time, recommend changes in work habits to the FTL. However, all changes that may affect the project written work control documents (HASP, RWPs, SWPs) must have concurrence from the appropriate project technical discipline representative on-Site and a data analysis report must be prepared, as required.

Personnel working at the task site are responsible for using safe-work techniques, reporting unsafe working conditions, and exercising good personal hygiene and housekeeping habits throughout the course of their job.

3.5.1 Material Handling and Back Strain

Material handling and maneuvering of various pieces of equipment may result in employee injury. All lifting and material-handling tasks will be performed in accordance with applicable company policies and procedures. Personnel will not physically lift objects weighing more than 22 kg (50 lb) or 33% of their body weight (whichever is less) alone. Additionally, back strain and ergonomic considerations must be given to material handling and equipment usage. Mechanical and hydraulic lifting devices should be used to move materials whenever possible. The industrial hygienist will conduct ergonomic evaluations of various project tasks to determine the potential ergonomic hazards and provide recommendations to mitigate these hazards. Applicable requirements from company policies and procedures will be followed.

3.5.2 Working and Walking Surfaces

Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. The various work surfaces associated with drilling and sampling activities present inherent tripping hazards because of uneven ground, equipment in use, and metal working surfaces. Additionally, the potential for slip, trip, and fall hazards will increase during winter months because of ice- and snow-covered surfaces combined with objects beneath the snow. During the prejob briefing, all personnel will be made aware of tripping hazards that cannot be eliminated. Tripping and slip hazards will be evaluated during the course of the project in accordance with applicable company policies and procedures.

3.5.3 Elevated Work Areas

Personnel may sometimes be required to work on elevated equipment or at heights above 1.8 m (6 ft). During such work, employees will comply with requirements from applicable company policies and procedures. Where required, a fall protection plan will be written.

3.5.4 Pressurized Systems

Drilling equipment operated on this project utilizes high pressure air and hydraulic systems. The hazards presented to personnel, equipment, facilities or the environment because of inadequately designed or improperly operated pressure systems include blast effects, shrapnel, fluid jets, release of toxic or asphyxiant materials, contamination, equipment damage, personnel injury, and death. These systems can include pneumatic, hydraulic, or compressed gas systems. The requirements of applicable company policies and procedures, and the manufacturer's operating and maintenance instructions must be followed. This includes inspection, maintenance, and testing of systems and components in conformance with American National Standards Institute (ANSI), Compressed Gas Association, etc.

All pressure systems will be operated in the designed operating pressure range, which is typically 10 to 20% less than the maximum allowable working pressure. Additionally, all hoses, fittings, lines, gauges, and system components will be rated for the system for at least the maximum allowable working pressure (generally the relief set point). The project safety professional should be consulted about any questions of pressure systems in use at the project site.

3.6 Drilling Hazards

Air rotary drilling (or equivalent) will be used to core to the required depths. Drilling personnel will be aware of potential drilling equipment hazards and body positioning during all material handling tasks. Specific hazards associated with drill rigs are described below. Additional hazards and mitigation information is described in the current project Well Drilling and Sampling JSA which must be followed by persons conducting drilling, monitoring, and sampling activities under this HASP.

3.6.1 Excavation, Surface Penetrations, and Outages

Excavation activities conducted in conjunction with drilling activities are considered ground penetrations. All surface penetrations and related outages will be coordinated through the and will require submittal of an outage request for outages (e.g., road, electrical, and water). The submission of an outage request will not be considered an approval to start the work. Other specific outage requirements are addressed in the special conditions section of the management and operating contract. No surface penetrations will be allowed or conducted until the area has been evaluated and an approved subsurface evaluation documented.

All excavation activities will be conducted and monitored in accordance with applicable company policies and procedures and 29 CFR 1926, Subpart P, "Excavations." The following are some key elements from these requirements:

- The location of utility installations (e.g., sewer, telephone, fuel, electric, water lines, or any other underground installations) that may reasonably be expected to be encountered during excavation work will be determined before opening an excavation.

- Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design and will be constructed in accordance with the design. Structural ramps will be inspected in accordance with applicable company forms.

- Employees exposed to public vehicular traffic will be provided with and will wear warning vests or other suitable garments marked with or made of reflecting or high-visibility material.

- Daily inspections of excavations, areas adjacent to the excavations, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by the competent person before the start of work and as needed throughout the shift. Inspections also will be made after every rainstorm or other hazard-increasing occurrence.

- Sloping or benching will be constructed and maintained in accordance with the requirements set forth in 29 CFR 1926, Subpart B, Appendix B, for the soil type as classified by the competent person. This classification of the soil deposits will be made based on the results of at least one visual inspection and at least one manual analysis.

3.6.2 Slips

Slips are toothed wedges positioned between the drill pipe and the master bushing of rotary cable to suspend the drill string in the well bore when it is not supported by the hoist. Most accidents, associated with slip operation are related to manual material handling; strained backs and shoulders are common.

3.6.3 Elevators

Elevators are a set of clamps affixed to the bails of the swivel below the traveling block. They are clamped to each side of a drill pipe and hold the pipe as it is pulled from the well bore. Accidents and injuries can occur during the latching and unlatching tasks; fingers and hands can get caught and crushed in the elevator latch mechanism. If the pipe is overhead when the latching mechanism fails, pipe may fall on workers on the drill floor.

3.6.4 Catlines/Hoist Lines

Catlines are used on drilling rigs to hoist material. Accidents that occur during catline operations may injure the worker doing the rigging, as well as the catline operator. Minimal control over hoisting materials can cause sudden and erratic load movements, which may result in hand and foot injuries.

3.6.5 Working Surfaces

The rig floor is the working surface for most tasks performed in well drilling operations. The surface is frequently wet from circulating fluid, muddy cuttings, and water used or removed from the borehole during drilling operations. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls.

3.6.6 Material Handling

The most common type of accident that occurs during material handling is when a load is being handled and a finger or toe is caught between two objects. Rolling stock can shift or fall from a pipe rack or truck bed. Fingers and hands can be caught between sampling barrels, breakout vices, and tools.

3.6.7 High-Pressure Lines

A high-pressure diversion system will be used to carry cuttings away from the borehole. All high-pressure lines will be equipped with positive locking connectors (e.g., cams) and be secured with properly rated whip checks in case of a connection failure. The project safety professional will be consulted about the rating and proper placements of whip checks or equivalent restraining devices.

3.6.8 Overhead Objects

Personnel may be exposed to falling overhead objects, debris, or equipment or impact hazards during the course of the project from drilling and well installation activities. Sources for these hazards will be identified and mitigated in accordance with applicable company policies and procedures. In the case of overhead impact hazards, they will be marked by using engineering-controls protective systems where there is a potential for falling debris, in combination with head protection PPE.

3.6.9 Hoisting and Rigging of Equipment

All hoisting and rigging of the materials during well installation, maintenance, and drilling activities will be performed in accordance with applicable company policies and procedures and DOE-STD-1090-01 “Hoisting and Rigging,” as applicable for this project. Hoisting and rigging equipment will show evidence of a current inspection (e.g., tag) and be inspected before use by qualified personnel. Additionally, the operator or designated person for mobile cranes or boom trucks will perform a visual inspection each day or before use (if the crane has not been in regular service) of items such as, but not limited to, the following:

- All control mechanisms for maladjustment that would interfere with proper operation
- Crane hooks and latches for deformation, cracks, and wear
- Hydraulic systems for proper oil level
- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage
- Hoist ropes for kinking, crushing, birdcaging, and corrosion

- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

Note: The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the safety professional.

3.7 Site Inspections

Project personnel may participate in site inspections during the work control preparation stage (such as the hazard identification and verification walkdowns), conduct self-assessments or other inspections. Additionally, the HSO, project manager, or FTL will perform periodic safety inspections in accordance with applicable company policies and procedures.

Targeted or required self-assessments may be performed during investigation and sampling operations in accordance with applicable company policies and procedures. All inspections and assessments will be documented and available for review by the FTL. These inspections will be noted in the FLT logbook. Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the FTL.

4. EXPOSURE MONITORING AND SAMPLING

A potential for exposure to radiological, chemical, and physical hazards exists during project tasks including well installation and routine sampling activities which may affect all personnel who work on the OU 3-13 Post-ROD Vadose Zone Monitoring and Aquifer Drilling project. Site Control and Security (Section 8) describes the use of engineering and administrative controls, worker training, and wearing PPE to provide the mitigation strategy for these hazards. Monitoring and sampling will be used during project tasks to (1) assess the effectiveness of these controls, (2) determine the type of PPE needed for individual tasks, and (3) determine the need for upgrading and downgrading of PPE as described in Section 6. Monitoring with direct-reading instruments will be conducted as deemed appropriate to provide RadCon and IH personnel with real-time data to assess the effectiveness of control measures.

Table 4-1 lists the tasks and hazards to be monitored, the frequency, and the monitoring instruments. Table 4-2 lists the action levels and associated responses for specific hazards.

4.1 Exposure Limits

Exposure limits are identified in Table 3-3 for specific project tasks. Project tasks will be continually assessed in accordance with applicable company policies and procedures and evaluated by RadCon and IH personnel to ensure engineering control effectiveness. Action limits should be adjusted as required based on changing site conditions, exposure mitigation practices, and PPE levels.

4.2 Action Limits

Action limits are one-half or 50% the exposure limits identified in Table 3-1 to serve as the initial limits for specific ICDF operations. Monitoring results at or above an action limit, identified through exposure monitoring, will initiate additional evaluations including consideration for improved engineering controls, administrative controls, reevaluation of personal protective equipment, and probable need for additional exposure monitoring based on the industrial hygienist's recommendations. Action limits may be adjusted based on changing site conditions, exposure mitigation practices, and PPE levels.

4.3 Environmental and Personnel Monitoring

RadCon and IH personnel will conduct initial and periodic monitoring of ICDF operations with direct-reading instruments, collect swipes, and conduct full- and partial-period air sampling, as deemed appropriate, in accordance with the applicable TPRs, MCPs, OSHA substance-specific standards, and as stated on work permits and other guidelines. As new ICDF processes or hazards are introduced, they will be evaluated and controlled in accordance with applicable company policies and procedures. Instrumentation listed on Table 4-1 will be selected based on the site-specific conditions and contaminants associated with project tasks. The RCT and IH will be responsible for determining the best monitoring technique for radiological and nonradiological contaminants respectively. Safety hazards and other physical hazards will be monitored and mitigated as outlined in Section 3.

Table 4-1. Tasks and hazards to be monitored, frequency, and monitoring instruments.

Tasks	Hazard(s) to be Monitored	Instrument Category to be Used	Instrument Category #	Monitoring Instruments Description[a,b]
Well drilling and instrument placement, repair, removal	Ionizing radiation—(alpha, beta, gamma)	1	1	(Alpha) Count rate—Bicron/NE Electra (DP-6 or AP-5 probe) or equivalent. Stationary—Eberline RM-25 (HP-380AB or HP-380A probe) or equivalent.
	Radionuclide contamination—(alpha, beta, gamma)	2		
	Chemical constituents—organic vapors, lead, cadmium	3, 4		(Beta-gamma) Count rate—Bicron NE/Electra (DP-6, BP-17 probes) or equivalent. Stationary—Eberline RM-25 (HP-360AB probe) or equivalent.
	Respirable dust—silica (area and personal)	3, 5		
	Hazardous noise	6	2	Continuous air monitor (CAM)—ALPHA 6-A-1 (in-line and radial sample heads, pump, RS-485) or equivalent (as required). CAM (beta)—AMS-4 (in-line and radial head, pump RS-485) or equivalent (as required). Grab sampler—SAIC H-810 or equivalent.
	Ergonomics, repetitive motion, lifting	7		
	Heat and cold stress	8		
Well sampling activities	Ionizing radiation—(alpha, beta, gamma)	1		
	Radionuclide contamination—(alpha, beta, gamma)	2	3	(Organic vapor) Direct reading instruments (photoionization detector, flame ionization detector, or infrared detector) detector tubes or grab samples.
	Respirable dust—silica (area)	4, 5		
Wastewater transfer/handling operations	Ionizing radiation—(alpha, beta, gamma)	1		(Dust) Direct-reading instrument (miniram).
	Radionuclide contamination—(alpha, beta, gamma)	2		
	Chemical constituents—organic vapors, lead	3, 4	4	(Organic vapors and lead) Personal sampling pumps with appropriate media for partial and full period sampling using NIOSH or OSHA-validated methods.
	Respirable dust—silica (area and personal)	3, 5		
	Hazardous noise	6		
	Ergonomics, repetitive motion, lifting	7		
	Heat and cold stress	8	5	(Silica dust, respirable) NIOSH 7500 or equivalent, personal sampling pump, 10-mm cyclone, full-period sampling.
	Radionuclide contamination—(alpha, beta, gamma)	2		
	Respirable dust—silica (area)	4, 5		

Table 4-1. (continued).

Tasks	Hazard(s) to be Monitored	Instrument Category to be Used	Instrument Category #	Monitoring Instruments Description[a,b]
Heavy equipment operations	Respirable dust—silica (area and personal)	4, 5	6	ANSI Type S2A sound level meter or ANSI S1.25-1991 dosimeter (A-weighted scale for time-weighed average dosimetry, C-weighted for impact dominant sound environments).
	Hazardous noise	6		
	Ergonomics, repetitive motion, lifting	7		
Decontamination of equipment	Radionuclide contamination—(alpha, beta, gamma)	2		
	Chemical constituents—organic vapors, lead, cadmium	3, 4	7	Observation and ergonomic assessment of activities in accordance with applicable company policies and procedures, and American Conference of Governmental Industrial Hygienists threshold limit value.
	Hazardous noise	6	8	Heat stress—wet-bulb globe temperature, body weight, fluid intake.
	Ergonomics, repetitive motion, lifting	7		
	Heat and cold stress	8		Cold stress—ambient air temperature, wind chill charts.

a. Monitoring and sampling will be conducted as deemed appropriate by project Industrial Hygiene and Radiological Control personnel based on specific tasks and site conditions.
b. Equivalent instrumentation other than those listed may be used.

able 4-2. Action levels and associated responses for the perc ed water project hazards.

Contaminant/Agent Monitored	Action Level	Response Taken If Action Levels Are Exceeded
Nuisance particulates (not otherwise classified)	>10 mg/m^3 (inhalable fraction) >3 mg/m^3 (respirable fraction)	Move personnel to upwind position of source and close equipment cab windows and doors. Use wetting or misting methods to minimize dust and particulate matter. IF wetting or misting methods prove ineffective, THEN don respiratory protection[a] (as directed by industrial hygienist).
Hazardous atmosphere	As defined by applicable company policies and procedures or based on one-half or 50% of the individual contaminant exposure limit, lower explosive limit (LEL), oxygen content, etc.	1. **Measure atmosphere prior** to initiating operation or personnel entry and verify specific limit or condition has been met (e.g., <LEL). 2. Utilize engineering controls to maintain safe atmosphere/below specified limit. 3. IF engineering control fails to control contaminant below safe atmospheric/exposure limit, THEN stop operation and evacuate personnel until safe atmosphere/specified limit can be achieved.
Silica (respirable fraction)	Greater than or equal to the OSHA permissible exposure limit of $\frac{10\ mg/m^3}{\%silica + 2}$ (29 CFR 1910.1000 [Z3])	Move personnel to upwind position of source. Use wetting or misting methods to minimize dust and particulate matter during mixing. IF wetting or misting methods prove ineffective, THEN don respiratory protection[a] (as directed by industrial hygienist).
Hazardous noise levels	<85 decibel A-weighted (dBA) 8-hour time-weighted average (TWA), <83dBA 10-hour TWA	No action.
	85 to 114 dBA	
	(a) >115 dBA (b) >140 dBA	(a) Isolate source, evaluate NRR for single device, double protection as needed. (b) Control entry, isolate source, only approved double protection worn.
Radiation field	<5 mrem/hour	
	5 to 100 mrem/hour @ 30 cm (10 CFR 835.603.b)	
	>100 mrem to 500 Rad @ 100 cm (10 CFR 835.603.b)	

Table 4-2. (continued).

Contaminant/Agent Monitored	Action Level	Response Taken If Action Levels Are Exceeded
Radionuclide contamination	1 to 100 times company determined limits[b] (10 CFR 835.603.d)	Post as "Contamination Area"—Required items: RW II training, personal dosimetry, RWP, don personal protective equipment (PPE), bioassay submittal (as required).
	>100 x company determined limits[b] (10 CFR 835.603.d)	Post as "High Contamination Area"—Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).
Airborne radioactivity	Concentrations (μCi/cc) >30% of and derived air concentration value (10 CFR 835.603.d)	Post as "Airborne Radioactivity Area"—Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).

a. Level C respiratory protection will consist of a full-face respirator equipped with a high-efficiency particulate air filter cartridge as prescribed by the project IH and RadCon personnel (based on contaminant of concern). See Section 5 for additional Level C requirements.
b. The project radiological engineer and/or the RCT will define company limits.

4.3.1 Industrial Hygiene Area and Personal Monitoring and Instrument Calibration

The project industrial hygienist will conduct full- and partial-period sampling of airborne contaminants and monitoring of physical agents at a frequency deemed appropriate based on direct-reading instrument readings and changing site conditions. When conducted, all air sampling will be conducted using applicable National Institute of Occupational Safety and Health (NIOSH), OSHA, or other validated method. Both personal and area sampling and monitoring may be conducted.

Various direct-reading instruments may be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, professional judgment, and in accordance with the applicable company policies and procedures.

All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing Industrial Hygiene protocol, and in conformance with the companywide safety and health manuals. Direct reading instruments will be calibrated, at a minimum, before daily use and more frequently as determined by the project industrial hygienist. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded as stated in Section 13.

4.3.2 Area Radiological Monitoring and Instrument Calibration

Area radiological monitoring will be conducted during project tasks to ensure that personnel are given adequate protection from potential radiological exposure. Instruments and sampling methods listed in Table 4-1 may be used by the RCT as deemed appropriate and as required by project or task-specific RWPs. When conducted, monitoring will be performed in accordance with applicable company manuals. The data obtained from monitoring will be used by RadCon personnel to evaluate the effectiveness of engineering controls, decontamination methods and procedures, and alert personnel to potential radiation sources.

Radiological Control personnel will use radiation and contamination detectors and counters listed in Table 4-1 or equivalent instruments to provide radiological information to personnel. Daily operational and source checks will be performed on all portable survey instruments used on this project to ensure they are within the specified baseline calibration limits. Accountable radioactive sources will be maintained in accordance with applicable company policies and procedures. All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations, existing RadCon protocol, and in conformance with applicable company policies and procedures.

4.3.2.1 External Dosimetry. Dosimetry requirements will be based on the radiation exposure potential during project tasks. When dosimetry is required, all personnel who enter the project area will be required to wear personal dosimetry devices, as specified by RadCon personnel and the RWP, and in accordance with the applicable company manuals.

When RWPs are required for project tasks, the Radiological Control and Information Management System (RCIMS) will be used to track external radiation exposures to personnel. Individuals are responsible for ensuring all required personal information is provided to RadCon personnel for entry into RCIMS and logging into RCIMS when electronic dosimeters are used.

4.3.2.2 Internal Monitoring. The purpose of internal dose monitoring is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes that may occur. Internal dose evaluation programs will be adequate to demonstrate compliance with 10 CFR 835, “Occupational Radiation Protection.” The requirement for whole body counts and bioassays will be based on specific project tasks or activities and will be the determination of the radiological engineer. Bioassay requirements will be specified on the RWP and project personnel will be responsible for submitting required bioassay samples upon request.

5. ACCIDENT AND EXPOSURE PREVENTION

Project activities will present numerous safety, physical, chemical, and radiological hazards to personnel conducting these tasks. It is critical that all personnel understand and follow the site-specific requirements of this HASP. Engineering controls, hazard isolation, specialized work practices, and the use of PPE will be implemented to eliminate or mitigate potential hazards and exposures, where feasible. However, all personnel are responsible for the identification and control of work area hazards in accordance with Integrated Safety Management System (ISMS) principals and practices. **At no time will hazards be left unmitigated without implementing some manner of controls (e.g., engineering controls, administrative controls, or the use of PPE).** Project personnel shall use stop work authority in accordance with applicable company policies and procedures where it is perceived that immanent danger to personnel, equipment, or the environment exists.

This HASP is to be used in conjunction with applicable company policies and procedures. Where appropriate, applicable company policies and procedures, mitigation guidance, JSAs, and RWPs will be incorporated into applicable sections of the HASP.

5.1 Voluntary Protection Program and Integrated Safety Management

The INEEL safety processes embrace the Voluntary Protection Program (VPP) and ISMS criteria, principles, and concepts to identify and mitigate hazards, thereby preventing accidents. All management and workers are responsible for implementing safety policies and programs and for maintaining a safe and healthful work environment. Project personnel are expected to take a proactive role in preventing accidents, ensuring safe working conditions for themselves and fellow personnel, and complying with all work control documents, procedures, and permits.

The **ISMS** is focused on the **system** side of conducting operations and **VPP** concentrates on the **people** aspect of conducting work. Both programs define work scope, identify and analyze hazards, and mitigate the hazards and additional information on these programs is available on the INEEL Intranet. BBWI (current primary management and operating contractor) and its subcontractors participate in VPP and ISMS for the safety of their employees. This document includes all elements of both systems. The five key elements of VPP and ISMS and their corresponding HASP sections are as follows:

Voluntary Protection Program	Integrated Safety Management System	Health and Safety Plan Section
	Define work scope	Section 2
Work site analysis	Analyze hazards	Section 3, 4, 6, 8,
Hazard prevention and control	Develop and implement controls	Section 3, 4, 5, 7, 8, 10, 11, 12
Safety and health training	Perform within work controls	Section 7
Employee involvement	Perform work within controls	Section 3, 4, 5
Management leadership	Provide feedback and improvement	Section 5, 10

5.2 General Safe-Work Practices

Sections 1 and 2 defined the project work scope and associated project-specific hazards with mitigation. The following practices are mandatory for all project personnel to further reduce the likelihood of accidents and injuries. All visitors permitted to enter work areas must follow these requirements. Failure to follow these practices may result in permanent removal from the project and other disciplinary actions. The project FTL and HSO will be responsible for ensuring the following safe-work practices are adhered to at the project site(s):

- Limit work area access to authorized personnel only, in accordance with applicable company policies and procedures and Section 7 of this document.
- All personnel have the authority to initiate STOP WORK actions in accordance with applicable company policies and procedures.
- Personnel will not eat, drink, chew gum or tobacco, smoke, apply sunscreen, or perform any other practice in CERCLA areas of in areas where there is an increased probability of hand-to-mouth transfer and ingestion of work areas contaminants.
- Be aware of and comply with all safety signs, tags, barriers, and color codes as identified in accordance with applicable company policies and procedures.
- Be alert for dangerous situations, strong or irritating odors, airborne dusts or vapors, and spills that may be present. Report all potentially dangerous situations to the FTL or HSO.
- Avoid direct contact with hazardous materials and waste. Personnel will not walk through spills or other contamination areas and will avoid kneeling, leaning, or sitting on equipment or potentially contaminated surfaces.
- Be familiar with the physical characteristics of the INTEC Facility, including, but not limited to:
  - Prevailing wind direction
  - Location of fellow personnel, equipment, and vehicles
  - Communications at the project site and with INTEC or CFA
  - Area and the type of hazardous materials stored and waste disposal materials
  - Major roads and means of access to and from the project site
  - Location of emergency equipment
  - Warning devices and alarms at INTEC and/or CFA
  - Capabilities and location of nearest emergency assistance.

- Report all broken skin or open wounds to the operations manager, FTL, or HSO. An OMP physician must examine all wounds to determine the nature and extent of the injury. If required to enter into a radiological contamination area, a RadCon supervisor will determine whether the wound can be bandaged adequately in accordance with applicable company manuals.

- Prevent releases of hazardous materials. If a spill occurs, personnel must try to isolate the source (if possible and if this does not create a greater exposure potential) and then report it to the FTL, or HSO. The Warning Communications Center (WCC) and INTEC shift supervisor will be notified and additional actions will be taken, as described in Section 11. Appropriate spill response kits or other containment and absorbent materials will be maintained at the project site

- Illumination levels during project tasks will be in accordance with 29 CFR 1910.120 (Table H-120.1, "Minimum Illumination Intensities in Foot-Candles").

- Ground-fault protection will be provided whenever electrical equipment is used outdoors.

- Keep all ignition sources at least 15 m (50 ft) from explosive or flammable environments and use nonsparking, explosion-proof equipment when working on systems containing flammable or explosive liquids, gases, and vapors.

- Follow all safety and radiological precautions and limitation of TPRs and requirements identified in work packages.

5.3 Subcontractor Responsibilities

Subcontractors are responsible for meeting all applicable requirements listed in the completed, applicable company forms, policies, and procedures as well as manuals, and contract general and special conditions. Additionally, subcontractor are expected to take a proactive role in hazard identification and mitigation while conducting project tasks and report unmitigated hazards to the project point of contact and HSO after taking mitigative actions within the documented work controls.

5.4 Radiological and Chemical Exposure Prevention

Exposure to potential chemical, radiological, and physical hazards will be mitigated by using of engineering controls, administrative controls, and PPE as a last means of defense to prevent and minimize exposure where engineering controls are not feasible. All project personnel are responsible for understanding the hazard identification and mitigation measures necessary to prevent exposures.

5.4.1 Radiological Exposure Prevention – As Low as Reasonably Achievable Principles

Radiation exposure of project personnel will be controlled such that radiation exposures are well below regulatory limits and that there is no radiation exposure without commensurate benefit. **Unplanned and preventable exposures are considered unacceptable.** All project tasks will be evaluated with the goal of eliminating or minimizing exposures. All project personnel have the responsibility for following as-low-as reasonably achievable (ALARA) principles and practices and personnel working at the site must strive to keep both external and internal radiation doses.

5.4.2 Chemical and Physical Hazard Exposure Avoidance

Note: Identification and control of exposures to carcinogens will be conducted in accordance with applicable company policies and procedures.

TLVs or other occupation exposure limits have been established for numerous chemicals and physical agents (e.g., noise, heat, or cold stress) that may be encountered. These exposure limits provide guidelines in evaluating airborne, skin, and physical agent exposures. The TLVs represent levels and conditions under which it is believed that nearly all workers may be exposed day after day without adverse health effects. The TLV-TWA is a time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects. Action limits (instantaneous concentrations for short time periods) have been established (Section 3) to further reduce the likelihood of exceeding TLVs.

Controls will be employed to eliminate or mitigate chemical and physical hazards wherever feasible. The hierarchy of controls in order are (1) engineering controls, (2) administrative controls, and (3) PPE. In addition to these controls, use of technical procedures and work orders, hold points, training, and monitoring of hazards will be used as appropriate to reduce exposure potential. Some methods of exposure avoidance include:

- Wearing all required PPE, inspecting all pieces before donning, and taping all seams
- Changing PPE if it becomes damaged or shows signs of degrading
- Minimizing time in direct contact with both hazardous material and waste
- Doff PPE following standard practices (i.e., rolling outer surfaces in and down) and follow doffing sequence
- Wash hands and face before eating, drinking, smoking, or engaging in activities that may provide contaminant pathways.

5.5 Buddy System

The two-person or buddy system will be used during project tasks. The buddy system is most often used during project activities requiring the use of protective clothing and respiratory protection where heat stress and other hazards may impede a person's ability to self-rescue. The buddy system requires each employee to assess and monitor his or her buddy's mental and physical well being during the course of the operation. A buddy must be able to perform the following activities:

- Provide assistance if required
- Verify the integrity of PPE

- Observe his or her buddy for signs and symptoms of heat stress, cold stress, or contaminant exposure

- Notify other personnel in the area if emergency assistance is needed.

The buddy system will be administered by the FTL in conjunction with the HSO.

6. PERSONAL PROTECTIVE EQUIPMENT

This section provides guidance for the selection and use of PPE to be worn for project tasks and contingencies for upgrading and downgrading PPE. Types of PPE are generally divided into two broad categories: (1) respiratory protective equipment and (2) PPE. Both of these categories are incorporated into the standard four levels of protection (Levels A, B, C, and D). Level D PPE is anticipated for all aspects of this project.

The purpose of personal protective clothing and equipment is to shield or isolate individuals from chemical, physical, radiological, biological, and safety hazards encountered during project tasks when engineering and other controls are not feasible or cannot provide adequate protection. It is important to realize that no one PPE ensemble can protect against all hazards under all conditions. Proper work practices and adequate training will serve to augment PPE usage to provide the greatest level of worker protection.

The PPE policy requires field workers wear, as a minimum, sturdy leather boots above the ankles, safety glass with side shields, and hard hats which is classified as level D. Safety boots will be required for activities where objects, materials, or equipment have the potential to fall on the feet of workers, occasional workers, visitors, and inspectors. The project HSO or safety professional will determine where and when this requirement will be invoked for each project.

The type of PPE will be selected, issued, used, and maintained in accordance with applicable company policies and procedures. Selection of the proper PPE is based on the following considerations:

- Specific conditions and nature of the tasks including well equipment installation, well monitoring, and well maintenance activities
- Potential contaminant routes of entry
- Physical form and chemical characteristics of hazardous materials, chemicals, or waste
- Toxicity of hazardous materials, chemicals, or waste
- Duration and intensity of exposure (acute or chronic)
- Compatibility of chemical(s) with PPE materials and potential for degradation or breakthrough
- Environmental conditions (e.g., humidity, heat, cold, rain)
- The hazard analysis (Section 3) evaluation of this HASP.

The PPE requirement for specific project tasks is identified in Table 6-1. This list may be augmented by the activity JSA and/or RWP. Potential exposures and hazards will be monitored (as discussed in Section 3) during the course of the project to evaluate changing conditions and determine PPE level adequacy and modifications.

Table 6-1. Task-based PPE requirements and modifications.

Task	Initial Level of Personal Protective Equipment	Upgrade Contingency	Downgrade Contingency	Upgrade or Downgrade Criteria	Personal Protective Equipment Modifications and Comments
Well drilling and instrument placement, repair, removal	D	C	D	Upgrade to Level C if airborne concentrations exceed action limits. Downgrade to Level D if contact with waste containers can be avoided or surveys show no detectable contamination on surfaces.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Leather gloves for all material handling tasks.
Well sampling activities	D	D+	N/A	Upgrade to Level D+ when attaching or removing straps if contamination is detected on the outside of waste containers.	D+ protective clothing consists of Tyvek hooded coveralls (or equivalent). Leather gloves.
Wastewater transfer/handling operations	D	D+	N/A	Upgrade to Level C if airborne levels exceed action limits. Downgrade to Level D if contact with waste containers can be avoided or surveys show no detectable contamination on surfaces.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Leather gloves for all material handling tasks.
Heavy equipment operations	D	D+	N/A	Upgrade to Level D+ if contact with waste material cannot be avoided.	D+ protective clothing consists of Tyvek hooded coveralls (or equivalent). Leather gloves.
Site grading	D	D+	N/A	Upgrade to Level C if airborne concentrations exceed the action limits.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Level C protective clothing consists of Tyvek hooded coveralls (or equivalent). Leather gloves for all material handling tasks.

Table 6-1. (continued).

Task	Initial Level of Personal Protective Equipment	Upgrade Contingency	Downgrade Contingency	Upgrade or Downgrade Criteria	Personal Protective Equipment Modifications and Comments
Equipment decontamination	C	C+	D+	Upgrade to Level C+ if splashing during decontamination of lead, cadmium, radiologically contaminated equipment cannot be avoided. Downgrade to Level D+ for decontamination of small items using spray and wipe decontamination methods.	Level C respiratory protection defined by industrial hygienist, based on airborne contaminant. Level C protective clothing consists of Tyvek (or equivalent) hooded coverall. Level C+ protective clothing consists of Saranex (or equivalent coated hooded coverall). Leather gloves over nitrile for equipment and material handling before or after decontamination tasks. Double pair nitrile gloves during decontamination tasks.

6.1 Respiratory Protection

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective will be to prevent atmospheric contamination. This will be accomplished as far as feasible by accepted engineering control measures (e.g., enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators will be selected and used.

Required task-based respiratory protection and protective clothing are listed on Table 6-1. Respirators will not be required for specific project tasks. All personnel required to wear respirators will complete training and be fit-tested before being assigned a respirator in accordance with the training and documentation requirements in Section 6. Requirements for respirator use, emergency use, storage, cleaning, and maintenance, as stated in the applicable company policies and procedures, will be followed.

6.2 Personal Protective Equipment Levels

Table 6-2 lists PPE requirements for the two levels of PPE that may be worn during the course of the project. Applicable PPE levels include level D and Level C PPE which will be required for conducting project tasks. Modifications to these levels will be made under the direction of the HSO in consultation with the project IH and RadCon personnel, as appropriate. Such modifications are routinely employed during Hazardous Waste Operations and Emergency Response (HAZWOPER) site activities to maximize efficiency and to meet site-specific needs without compromising personnel safety and health. Level D PPE is the anticipated level of protection for project activities and will be upgraded if warranted by the presence of contaminants above action limits.

6.2.1 Level D Personal Protective Equipment

Level D PPE will only be selected for protective clothing and not on a site with respiratory or skin absorption hazards requiring whole-body protection. Level D PPE provides no protection against airborne chemical hazards, but rather is used for protection against surface contamination and physical hazards. Level D PPE will only be allowed in areas that have been characterized as having limited contamination hazards.

6.2.2 Level C Personal Protective Equipment

Level C PPE will be worn when the task site chemical and radiological contaminants have been well-characterized indicating that personnel are protected from airborne exposures by wearing an air-purifying respirator with the appropriate cartridges, no oxygen-deficient environments exist (less than 19.5% at sea level), and that there are no conditions that pose immediate danger to life or health.

Table 6-2. Levels and options of PPE.

Personal Protective Equipment Level	PPE Required	Optional Personal Protective Equipment or Modifications
D	Coveralls or standard work clothes (coverall material type based on industrial hygiene determination). Hard hat (unless working indoors with no overhead or falling debris hazards) meeting ANSI Z89.1 requirements. Eye protection (safety glasses meeting ANSI Z87.1 requirements as a minimum). Hand protection (material based on type of work and hazardous materials being handled). Safety footwear (steel or protective toe and shank) meeting ANSI Z41 requirements or sturdy leather above the ankle for construction tasks.	Chemical or radiological protective clothing (Tyvek or Saranex) by industrial hygienist or RCT. Chemically resistant hand and foot protection (e.g., inner and outer gloves and boot liners). Radiological modesty garments under outer protective clothing (as required by RWP). Any specialized protective equipment (e.g., hearing protection, cryogenic gloves, face shields, welding goggles, and aprons).
C	Level D ensemble with the following respiratory and whole-body protection upgrades:[a] • Full-facepiece air purifying respirator equipped with a NIOSH-approved high-efficiency particulate air (HEPA) filter or chemical combination cartridge (industrial hygienist to specify cartridge type) **OR** • An air hood operating at a minimum pressure of 6 cfm or a full-facepiece supplied air respirator with a 10-minute escape bottle, a self-contained breathing apparatus (SCBA) or an escape air-purifying combination HEPA or chemical cartridge (supplied air respirator hose length no more manufacturer's specification and under no circumstances greater than 91 m [300 ft]) • Standard Tyvek (or equivalent) coverall **OR** • Chemical-resistant coveralls (e.g., Tyvek QC, Tychem 7500, or Saranex-23-P) (industrial hygienist to specify material).	Chemical-resistant outer shoe or boot cover (industrial hygienist or RCT to specify material). Inner chemical-resistant gloves with cotton liners (as determined by the industrial hygienist and RWP). Outer chemical-resistant gloves (as determined by the industrial hygienist). Radiological modesty garments under outer protective clothing (as required by RWP). Any specialized protective equipment (e.g., hearing protection, welding lens, and aprons).

a. Upgrades are determined by the industrial hygienist in conjunction with other environment, safety, and health professionals.

Note: Personnel must inspect all PPE before donning and entry into any work zone. Items found to be defective or that become unserviceable during use, will be doffed and disposed of in accordance with posted procedures and placed into the appropriate waste stream. The PPE inspection guidance is provided in Table 6-1.

6.3 Personal Protective Clothing Upgrading and Downgrading

The project HSO, in consultation with the project industrial hygienist and RadCon personnel, will be responsible for determining when to upgrade or downgrade PPE requirements. Upgrading or downgrading of PPE based on changing site conditions or activities is a normal occurrence. Action levels listed in Table 3-2 serve as the initial basis for making such decisions. Additional reasons for upgrading or downgrading are listed in the following subsections.

6.3.1 Upgrading Criteria for Personal Protective Equipment

The level of PPE required will be upgraded for the following reasons and work will halt until PPE upgrading has been completed:

- Identification of new, unstable, or unpredictable site hazards
- Temporary loss or failure of any engineering controls
- Contaminants that present difficulty in monitoring or detecting
- Known or suspected presence of skin absorption hazards
- Identified source or potential source of respiratory hazard(s) not anticipated
- Change in the task procedure that may result in an increased contact with contaminants or meeting any of the criteria listed above.

6.3.2 Downgrading Criteria

The level of PPE will be downgraded under the following conditions:

- Elimination of hazard or completion of task(s) requiring specific PPE
- Implementation of new engineering or administrative controls that eliminate or significantly mitigate hazard
- Sampling information or monitoring data that show the contaminant levels to be stable and lower than established action limits
- Elimination of potential skin absorption or contact hazards.

6.3.3 Inspection of Personal Protective Equipment

All PPE ensemble components must be inspected before use and when in use within project work zones. Self-inspection and the use of the buddy system, once PPE is donned, will serve as the principle forms of inspection. If PPE should become damaged or degradation or permeation is suspected, the individual wearing the PPE will inform others of the problem and proceed directly to the work zone exit point to doff and replace the unserviceable PPE. Table 6-3 provides an inspection checklist for common PPE items. Where specialized protective clothing or respiratory protection is used or required, the manufacturer's inspection requirements in conjunction with regulatory or industry inspection practices will be followed. Consult the project industrial hygienist, safety professional, and RCT about PPE inspection criteria.

Table 6-3. Inspection checklist for personal protection equipment.

Personal Protection Equipment Item	Inspection
Respirators (full-facepiece air-purifying and supplied air respirators with escape-only SCBA bottles or escape cartridges)	Before use: Ensure airline matches the airline respirator to be used (black hose). Inspect airline hose connections (sections of hose) to ensure all are threaded or permanent metal-to-metal connections (no quick disconnect pieces). Check condition of the facepiece, head straps, valves, connecting lines, fittings, and all connections for tightness. Check cartridge to ensure proper type or combination are being used for atmospheric hazards to be encountered, and inspect threads and O-rings for pliability, deterioration, and distortion. Check for proper setting and operation of regulators and valves, check all hose connections back to the breathing-air compressor, check the pressure to the airline station and on individual airline connections to ensure pressure is within required range (in accordance with the manufacturer's specifications).
Level D and C clothing	Before use: Visually inspect for imperfect seams, nonuniform coatings, and tears. Hold PPE up to the light and inspect for pinholes, deterioration, stiffness, and cracks. While wearing in the work zone: Inspect for evidence of chemical attack such as discoloration, swelling, softening, and material degradation. Inspect for tears, punctures, and zipper or seam damage. Check all taped areas to ensure they are still intact.
Gloves	Before use: Pressurize rubber gloves to check for pinholes: blow in the glove, then roll until air is trapped and inspect. No air should escape. Leather gloves: Inspect seams and glove surface for tears and splitting and verify no permeation has taken place.